

II. Remarks/Arguments

Claims 1–28 were previously pending, of which claims 1, 7, 15–26, and 28 have been canceled, claims 2, 4–6, 8, 10–11, and 13 have been amended, and claims 46–50 have been added. Claims 29–45 were previously withdrawn, of which claims 29–45 have been canceled. Reconsideration of presently pending claims 1–28 and claims 46–50 is respectfully requested in light of the above amendments and the following remarks.

Rejections Under 35 U.S.C. § 112

Claims 2–9, 12–13, 17–19, and 23 were rejected under 35 U.S.C. §112, second paragraph. Examiner asserts that the claims were indefinite for failing to particularly point out and distinctly claim the subject matter. Claims 7, 17–19, and 23 have been canceled.

Claim 2 has been amended to delete mention of a layer of pad oxide. Claim 4 has been amended to have proper antecedent basis per Examiner's request by changing "a metal" to "an inductor material." Claims 5, 6, and 13 have been amended to remove the indefinite language within the claims. Claims 3, 8–9, and 12 were rejected for failing to cure the indefiniteness of their base claim. The base claims for claims 3, 8–9, and 12 have been amended to cure any indefiniteness and the base claims are now in condition for allowance. Therefore, claims 3, 8–9, and 12 are no longer needed to cure the indefiniteness of their base claim.

Thus, Applicant respectfully requests that the Examiner withdraw the § 112 rejections of claims 2–6, 8–9, 12–13.

Rejections Under 35 U.S.C. § 102

Claim 1 was rejected under 35 U.S.C. §102(b) as being anticipated by Begley, et al. (US Patent No. 6,211,056 B1 hereinafter referred to as "Begley"). Claim 1 has been canceled.

Rejections Under 35 U.S.C. § 103

Claims 2–28 were rejected under 35 U.S.C. §103(a) as being unpatentable over Begley, et al. (US Patent No. 6,211,056 B1 hereinafter referred to as "Begley") in view of Zhao, et al. (US Patent No.

2002/0148807 A1 hereinafter referred to as "Zhao"). Claims 7, 15-26, and 28 have been canceled. Claim 2 has been amended to stand as an independent claim and is in condition for allowance. Applicant traverses the rejection of claims 2-6, 8-14, and 27 on the grounds that the Begley and Zhao references are defective in establishing a prima facie case of obviousness with respect to claims 2-6, 8-14, and 27.

As the PTO recognizes in MPEP § 2142:

... The examiner bears the initial burden of factually supporting any prima facie conclusion of obviousness. If the examiner does not produce a prima facie case, the applicant is under no obligation to submit evidence of nonobviousness...

It is submitted that, in the present case, the Examiner has not factually supported a prima facie case of obviousness for the following, mutually exclusive, reasons.

- Independent Claim 2 -

1. Even When Combined, the References Do Not Teach the Claimed Subject Matter

The Begley and Zhao patents cannot be applied to reject claim 2 under 35 U.S.C. § 103(a). Neither Begley nor Zhao teach having an air gap as the surrounding medium alone around the inductor material. Figure 7 of Applicant is shown below:

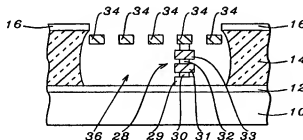


FIG. 7

As shown above in Figure 7, Applicant's structure consists of suspended inductor material 34 alone. The inductor material is not directly surrounded by any dielectric material. Applicant's structure has only the

air gap 36 as the surrounding medium for the suspended inductor material 34 (page 4, paragraph 0055). The Begley and Zhao references create structures with dielectric material as the surrounding medium of the inductor material.

As shown in Figure 5 of Begley below, Begley teaches surrounding the suspended inductor material with sheaths of dielectric. Begley's method creates a structure that consists of a metal 242 (the inductor material) surrounded by nitride sheaths 249 (column 4, lines 50–65). The Begley reference

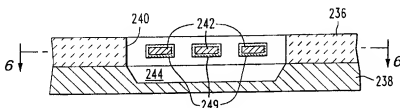


FIG. 5

requires the creation of sheaths around the inductor material (column 4, lines 26–65). Begley specifically states that the “[s]heaths around the conductors protect the conductors against contamination or damage” (column 4, lines 61–65). Begley specifying that such sheaths are desirable does not teach a method where the inductor material is surrounded by an air gap only. Further, Begley specifically teaches “covering the conductive material with the second dielectric to **sheath the conductive material** in a layer of the second dielectric” (column 7, lines 27–28), not “etching the exposed surface area of said layer of dielectric, thereby creating an air gap in said layer of dielectric, said **air gap surrounding said inductor material**.” (emphasis added) Further, no figures in the Begley reference indicate or suggest an air gap as the surrounding medium of the inductor material.

Figure 2d of Zhao is shown below:

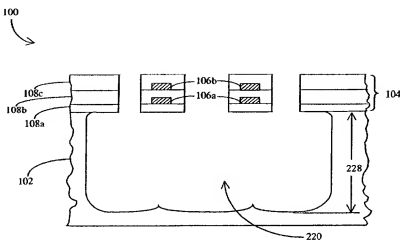


Fig. 2d

As shown in Figure 2d above, Zhao's method creates a structure with metal layers surrounded by numerous dielectric layers. The metal layers 106a and 106b are similarly surrounded by dielectric layers 108a, 108b, and 108c (page 2, paragraph 0018). Further, no figures in the Zhao reference indicate or suggest an air gap as the surrounding medium of the inductor material.

Neither Begley, Zhao, nor Begley in view of Zhao teach one to have an air gap alone as the surrounding medium for the suspending inductor material. Thus, for this mutually exclusive reason, the Examiner's burden of factually supporting a *prima facie* case of obviousness has clearly not been met, and the rejection under 35 U.S.C. §103 should be withdrawn.

2. Prior Art That Teaches Away From the Claimed Invention Cannot be Used to Establish Obviousness

Both the Begley and Zhao references teach away from suspending the inductor material alone in the air gap. In the present case, the Begley reference, by specifically teaching in claim 1 (column 7, lines 30-34):

“opening one or more trenches in the dielectric layer;
coating the trenches with a second dielectric material;
depositing conductive material in the coated trenches;

covering the conductive material with the second dielectric to sheath the conductive material in a layer of the second dielectric; [and]
selectively etching the first dielectric material to create a cavity in the first dielectric layer and to expose the sheath of the second dielectric.”

clearly teaches away from amended claim 2, which requires:

“patterning and etching said layer of etch stop material, thereby creating a pattern of said inductor through the layer of etch stop material;
etching said layer of dielectric to a measurable depth in accordance with said pattern created through said layer of etch stop material, creating a pattern for said inductor in said layer of dielectric;
filling said pattern created in said layer of dielectric with an inductor material to a measurable height[.];
exposing the surface area of said layer of dielectric; and
etching the exposed surface area of said layer of dielectric, thereby creating an air gap in said layer of dielectric, said air gap surrounding said inductor material.”

As discussed above, Begley and Zhao teach away from having only the air gap as a surrounding medium of the suspending inductor material. To the contrary, Begley emphasizes that that the sheaths surrounding the inductor material are important to protect from contamination or damage. Such emphasis teaches away from the air gap as a surrounding medium. Applicant respectfully contends that the Begley reference specifically teaching “covering the conductive material with the second dielectric to sheath the conductive material in a layer of the second dielectric” teaches away from amended claim 2 which teaches “etching the exposed surface area of said layer of dielectric, thereby creating an air gap in said layer of dielectric, said air gap surrounding said inductor material.”

Thus, for this reason alone, the Examiner’s burden of factually supporting a *prima facie* case of obviousness has clearly not been met, and the rejection to claim 2 under 35 U.S.C. §103(a) should be withdrawn.

3. Recognition of a Problem, or of the Source of the Problem, is not Obvious Even Though the Solution to the Problem may be Obvious

In the present case, it is apparent from a reading of the Begley and Zhao patents that neither recognized the source of the problem—dielectric as the surrounding medium of the suspended inductor. Applicant has proposed creating the suspended inductor with air as the surrounding medium, creating a

suspended inductor with a higher Q-value, further increasing the frequency at which a high-Q on-chip inductor can operate. Thus, this is a classic example of a solution to a problem being obvious only after recognition of the source of the problem by the applicant and is part of the “subject matter as a whole” language of 35 U.S.C. § 103 which should always be considered in determining the obviousness of an invention under this statute.

Furthermore, the MPEP provides at § 2143.01:

The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.

In the above context, the courts have repeatedly held that obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination.

Applicant’s method recognizes that suspending the inductor material alone (without surrounding dielectric) significantly reduces electromagnetic coupling and parasitic capacitance, resulting in a higher-Q on-chip inductor that operates at a higher frequency. Though the Begley and Zhao patents both address reducing electromagnetic coupling and parasitic capacitance, neither teaches, suggests, or provides any incentive that suspending the inductor material alone without a dielectric sheath would remedy the high parasitic capacitances. As discussed above, to the contrary, Begley and Zhao teach away from having a suspended inductor surrounded by air alone. In fact, Begley emphasizes that the dielectric sheaths provide protection. Further, no figures in the Begley or Zhao references suggest suspending the inductor in an air only medium.

Applicant provided a solution, surrounding the inductor material by an air medium only instead of a dielectric, to a problem, further reducing coupling and parasitic capacitance, obvious only after recognition of the problem by the Applicant. Applicant’s method and accompanying structure “reduces the capacitance between the metal traces of the inductor in the plane of the traces...[and] between the metal traces of the inductor and the underlying substrate” (page 5, paragraph 0070–71). Further, it results

in an improved Q-value from 4.8 (at 1.5 GHz) to 6.3 (at 2 GHz), obtained by Applicant's inductor surrounded by air alone (page 5, paragraph 0066). This method, by using only an air gap as the surrounding medium, instead of a dielectric as proposed in the Begley and Zhao references, provides an approximate 31% improvement in the Q-value and an approximate 33% improvement in the frequency for the maximum Q-value (page 5, paragraph 0066).

Applicant recognized that changing the inductor's surrounding medium from a dielectric to air would increase the Q-value and frequencies. Thus, for this independent reason, the Examiner's burden of factually supporting a *prima facie* case of obviousness has clearly not been met, and the rejection under 35 U.S.C. §103 should be withdrawn.

4. The Combination of References is Improper – No Motivation to Modify the References to Reach the Presently Claimed Invention

Assuming, arguendo, that none of the above arguments for non-obviousness apply (which is clearly not the case based on the above), there is still another, mutually exclusive, and compelling reason why the Begley and Zhao patents cannot be applied to reject claim 2 under 35 U.S.C. § 103.

§ 2142 of the MPEP also provides:

...the examiner must step backward in time and into the shoes worn by the hypothetical 'person of ordinary skill in the art' when the invention was unknown and just before it was made.....The examiner must put aside knowledge of the applicant's disclosure, refrain from using hindsight, and consider the subject matter claimed 'as a whole'.

One of ordinary skill in the art would not have been led to modify Begley's and Zhao's teaching to create suspended inductor material surrounded by air only, because there is no teaching or suggestion in Begley or Zhao of surrounding the inductor material with anything other than a dielectric. To the contrary, as discussed above, Begley specifically discloses surrounding the inductor material in dielectric sheaths to protect from contamination and damage. Further, Zhao's CMOS example has the inductor material surrounded by several layers of dielectric material. Therefore, in Begley, Zhao, or Begley in view of Zhao, there is no incentive to suspend the inductor material surrounded by air alone.

Thus, it is clear that the Begley and Zhao patents fail to provide any incentive or motivation supporting the modification. Absent some disclosure by the Applicant, a person of ordinary skill in the art would not have been led to modify the teachings of Begley or Zhao to provide only the air gap as the inductor material's surrounding medium. Therefore, for this mutually exclusive reason, the Examiner's burden of factually supporting a *prima facie* case of obviousness has clearly not been met, and the rejection to claim 2 under 35 U.S.C. §103(a) should be withdrawn.

– Dependent Claims 3–6, 8–14, and 27 –

Claims 3–6, 8–14, and 27 are dependent claims that depend from and further limit independent claim 2. Since independent claim 2 has been amended to overcome the prior art references and is in condition for allowance, Applicant respectfully submits that dependent claims 3–6, 8–14, and 27 are patentable over the cited art.

New Claims 46–50

Claim 46 has been added as an independent claim. Claims 47–50 have been added as dependent claims, and each of claims 47–50 limits claim 46 further. Applicant respectfully submits that independent claim 46 is patentable over the cited art. Thus, claims 46–50 are in condition for allowance.

Conclusion

It is clear from all of the foregoing that independent claim 2 is in condition for allowance. Dependent claims 3–6, 8–14, and 27 depend from and further limit independent claim 2 and therefore are allowable as well. Further, claims 46–50 have been added, and Applicant respectfully submits that independent claim 46 is in condition for allowance. Dependent claims 47–50 depend from and further limit independent claim 46 and therefore are allowable as well.

An early formal notice of allowance of claims 2-6, 8-14, 27, and 46-50 is requested. An early action on the merits is respectfully requested.

Respectfully submitted,



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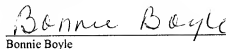
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